

Smallpox

Bioterrorism Agent Profiles for Health Care Workers

Causative Agent: Smallpox is an acute viral illness caused by the orthopox virus, variola. There are two different strains of the virus, variola major and variola minor. Variola major causes a more severe illness.

Routes of Exposure: Inhalational or contact with skin lesions or secretions

Infective Dose & Infectivity: The infectious dose is unknown, but it is believed to be 10-100 virions.

Incubation Period: The incubation period of smallpox ranges from 7-17 days, with an average of 12 days.

Clinical Effects: The illness begins with a prodrome lasting 2-3 days, with generalized malaise, fever, rigors, headache, and backache. Severe abdominal pain and delirium are sometimes present. This is followed by transient defervescence and the appearance of a typical skin eruption characterized by progression over a period of 7 to 10 days. Lesions progress through successive stages, from macules to papules, to vesicles, to pustules. The distribution of lesions is centrifugal, and the rash is generally most prominent on the face and extremities. Approximately 10% of smallpox cases will present in either the hemorrhagic or malignant form, which have a more severe clinical course. The hemorrhagic form of smallpox generally has a shorter incubation period and is characterized by a severely prostrating prodromal illness, followed by hemorrhagic skin lesions. In the malignant form, the lesions remain soft, flattened and velvety to the touch.

Laboratory testing: Demonstration of characteristic virions on electron microscopy of vesicular scrapings is the most common and simple method of diagnosis. Under light microscopy, aggregations of variola viral particles known as Guarnieri bodies can be identified. Gispén's modified silver stain can also be used rapidly, but although both methods are rapid and simple, they have relatively low sensitivity. If microscopy is not available, vesicular fluid antigen from a pus lesion can be incubated with vaccine hyperimmune serum and the gel diffusion test can be performed. However, none of the previously mentioned tests are able to differentiate smallpox from either cowpox or monkeypox. The only method that can unequivocally diagnose smallpox is PCR.

Lethality: The mortality rate of smallpox is 20-50% in unvaccinated individuals. Hemorrhagic and malignant cases are 95-100% fatal.

Transmissibility: Person-to-person transmission is likely from airborne or droplet exposure, or by contact with skin lesions or secretions. Patients are considered more infectious if they are coughing or if they have a hemorrhagic form of smallpox.

Primary contamination & Methods of Dissemination: Smallpox would most likely be delivered through aerosolization.

Secondary Contamination & Persistence of organism: Secondary contamination is a significant issue. Patients with smallpox become infectious at the onset of the rash and remain infectious until their scabs separate, approximately three weeks.

Decontamination & Isolation:

Patients- Airborne and contact precautions should be used in addition to standard precautions for patients with smallpox.

Equipment, clothing & other objects- Contaminated clothes and bed linens can spread the virus. Therefore, all laundry and waste should be placed in biohazard bags and autoclaved before being laundered or incinerated. Laundering should be done using hot water to which bleach has been added. Disinfectants that are used for standard hospital control, such as hypochlorite or quaternary ammonia, are effective for cleaning surfaces possibly contaminated with virus.

Outbreak control: Control of smallpox is based upon vaccination with the vaccinia virus. A suspect case of smallpox should be considered a public health emergency and the local and state health department should be notified immediately. As soon as the diagnosis of smallpox is made, all suspected smallpox cases should be isolated. Additionally, all household and face-to-face contacts should be vaccinated and isolated immediately. The smallpox vaccine does not confer lifelong immunity. All hospital employees as well as patients in the hospital should be vaccinated as soon as a case is identified.

Treatment: There is no approved effective anti-viral treatment for smallpox.

Prophylaxis: A highly effective smallpox vaccine (vaccinia virus) exists and was utilized for the smallpox eradication campaign. However, because only small amounts of the vaccine are still in existence, and the risk of exposure is extremely low, a preventive vaccination program is not an option at this time.

Within three days of exposure to the smallpox virus, the recommended prophylaxis is immunization with the smallpox vaccine (vaccinia virus). After three days, passive immunization with vaccinia immune globulin (VIG) .3ml/kg IM is recommended in addition to immunization with the smallpox vaccine.

Vaccinia immune globulin (VIG) should be given in conjunction with the vaccine to all individuals who need vaccination but are also at risk of developing vaccine-related complications.

Differential Diagnosis: The differential diagnoses should include chickenpox and monkey pox. In contrast to the rash of varicella, which arises in crops, variola rash has a synchronous onset. Therefore, all lesions will be in the same stage of development at any point in time. Furthermore, varicella lesions are much more superficial and are almost never found on the palms or soles. Monkey pox, a naturally occurring relative of smallpox, occurs in Africa and is clinically indistinguishable from smallpox, with the exception of notable enlargement of cervical and inguinal lymph nodes. Additionally, cases that present in the hemorrhagic form can be misdiagnosed as meningococemia or severe acute leukemia.

References:

Chin, James. *Control of Communicable Diseases Manual*, Seventeenth Edition, American Public Health Association, 2000.

Henderson DA, Inglesby TV, Bartlett JG, et al for the Working Group on Civilian Biodefense. *Smallpox as a Biological Weapon: medical and public health management*, JAMA Consensus Statement, 1999; 281: 2127-2137.

Kortepeter M, Christopher G, Cieslak T, et al. *Medical Management of Biological Casualties Handbook*, U.S. Army Medical Research Institute of Infectious Diseases, U.S. Department of Defense, February 2001. Available at <http://www.nbc-med.org/SiteContent/HomePage/WhatsNew/MedManual/Feb01/handbook.htm>. Accessed September 2001.

Sidell FR, Takafuji ET, Franz DR. *Military Aspects of Chemical and Biological Warfare*. Office of the Surgeon General, U. S. Army. Borden Inst., WRAMC, 1997.

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